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Method and apparatus for remote self-propelled conveying in mineral deposits

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Invention Title:

METHOD AND APPARATUS FOR REMOTE SELF-PROPELLED CONVEYING IN MINERAL DEPOSITS

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The following statement is a full description of this invention, including the best method of performing it known to applicant(s):

ABSTRACT

A method and apparatus for mining of aggregate material from a seam includes a mining apparatus and a self-propelled conveyor capable of advancing or retreating in the seam on its own power and advancing and steering arrangement for the mining apparatus. The self-propelled conveyor, the electric cables and other services for the mining apparatus are protected against the roof falls. The power input for the self-propelled conveyor is provided by continuous drive shafts powered at either one or both ends of the conveyor. Alternately, a unique reciprocating conveyor mechanically powered at either one or both ends of is provided for conveying of aggregate material. An apparatus for assembling the conveyor and receiving of aggregate material is provided at the rear end of the conveyor.

METHOD AND APPARATUS FOR REMOTE SELF-PROPELLED CONVEYING IN MINERAL DEPOSITS

FIELD OF THE INVENTION

The present invention relates generally to mining and specifically to conveying in remote mining of bedded mineral deposits.

BACKGROUND OF THE INVENTION

Methods of remote mining in bedded mineral deposits such as coal seams employ a mining machine that excavates mine openings to some distance from the seam exposure on the surface and means of conveying are required to transport the excavated material to the surface. In most of the present systems, means of conveying consisting of multiple conveyors are advanced into the mine openings from the surface. For example, U.S. Patents No. 5,112,111, 5,232,269 and 5, 261,729 to Addington at al. disclose an assembly of conveyors and a mining machine advanced into the seam without interrupting the flow of aggregate material by separate means designed to pull at the forward end and push at the rearward end. Similarly, U.S. Patent No. 5,609,397 to Marshall at al. discloses an assembly of conveyors interconnected with a mining machine and a driving device located outside the seam and consisting of rack and pinion or, alternately, reciprocating cylinders, linear tracks, linear or rotary drives, chains, cables or other mechanical devices. The U.S. Patent 5,692,807 to Zimmerman discloses a guidance assembly for extending and retracting

an assembly of conveyors in and out of the seam. The U.S. Patent 3,497,055 to Oslakovic at al. discloses a multi-unit train of conveyors having a self-propelled unit at each end coupled to intermediate units, each end unit being capable of towing the intermediate units. The U.S. Patent 2,826,402 to Alspaugh at al. discloses a train of wheeled conveyor sections pulled into the mine opening and pushed out of it by a self-propelled mining machine. Buckling of the train is avoided by the grooves made by the mining machine in the floor, said grooves spaced the same distance as the treads of the wheels carrying the conveyor sections.

At present, as the interconnected assembly of the mining machine and a plurality of conveyors is advanced some distance into the seam from a launch vehicle located on the outside, the axial force within the assembly becomes excessive with respect to it's length and the assembly becomes less rigid. As a consequence, it becomes difficult to steer the mining machine located at the front of the assembly and the conveying assembly itself can become unstable, which limits the penetration depth of mining. As well, pulling the conveying assembly at the rearward end when it becomes entrapped by a rock fall may sometimes cause the conveying assembly to brake. It would be therefore desirable to provide means of advancing and withdrawing of the conveying assembly that minimizes the axial force within the conveying assembly.

Where the conveying means consists of a plurality of conveyor units, each of the individual conveyors requires a separate input of electric power which, in turn, requires coupling and uncoupling of electrical cables as the assembly is advanced into or retracted from the mine opening. It would be therefore desirable to provide a power input that does not require electric power at each individual conveyor of the assembly.

If the electric power input is not provided at each individual conveyor, the conveying assembly cannot be extended without interrupting of conveying, as claimed in the U.S. Patent No. 5,112,111 to Addington at al. It would be therefore desirable to provide means of extending the conveying assembly that minimizes the time required for an extension of the assembly.

Where open conveyors are used, they are prone to damage by falls of rock from unsupported roof. Often, when rock falls occur, mining must be interrupted and the conveying assembly brought to the surface, in order to remove rock fallen onto the assembly and repair damage. It would be therefore desirable to provide means of conveying that is enclosed in a protective enclosure, capable of withstanding at least moderate rock falls.

Electric cables, control cables and hoses for the remote mining machine that lay on the top of the conveying assembly are also prone to damage by rock falls. It would be therefore desirable to provide protective enclosures for cables, hoses and other services provided for the remote mining machine.

The remote mining machine located at the forward end of the conveying assembly may become entrapped by fallen rock and the traction force of the said conveying assembly may not be sufficient to extract the said mining machine. It would be therefore desirable to provide independent means of extracting the mining machine from the seam.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a method and apparatus for advancing a remote conveying assembly without causing excessive axial forces within the said assembly, by providing tractive forces at multiple locations along the length of the said assembly.

Another object of the present invention is to provide a method and apparatus for remote conveying that does not require electric power at each conveying section of the conveying assembly.

Another object of the present invention is to provide a method and apparatus for extending of the conveying assembly that minimizes the time required for extensions.

Another object of the present invention is to provide a method and apparatus for protecting the remote conveying assembly, electric cables and other services from damage by rock falls.

Another object of the present invention is to provide a method and apparatus for advancing and steering of the remote mining machine independently of advancing of the conveying assembly.

These and other objects of the present invention will become clear from the detailed description of the invention and the claims included below.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic side view of the first part of the preferred embodiment of the present invention located outside the seam, including a mining platform, stacker and a rearward end of the conveying assembly;

FIG. 2 is a schematic plan view taken along line I-I of FIG. 1;

FIG. 1A is a schematic side view of the assembly in Figure 1, showing the conveying assembly advancing into the seam;

FIG. 2A is a schematic plan view taken along line I-I of FIG. 1A;

FIG. 3 is a schematic side view of the second part of the preferred embodiment of the present invention, located inside the seam, including a forward end of the conveying assembly, feeder/breaker, advancing cylinders, side jacks and a mining machine;

FIG. 4 is a schematic plan view taken along line II-II of FIG. 3;

FIG. 4A is a schematic plan view taken along line II-II of FIG. 3, showing the advancing cylinders extended and the mining machine advanced ahead of the conveying assembly;

FIG. 5 is a schematic side view of a component of the conveying assembly utilizing belt conveyors;

FIG. 6 is a schematic plan view taken along line III-III of FIG. 5;

FIG. 7 is a schematic sectional view taken along line IV-IV of FIG. 6;

FIG. 8 is a schematic sectional view taken along line V-V of FIG. 6;

FIG. 9 is a schematic sectional view similar to FIG. 8, utilizing chain conveyors;

FIG. 10 is a schematic side view of a component of the conveying assembly utilizing a reciprocating conveyor;

FIG. 11 is a schematic plan view taken along line VI-VI of FIG. 10;

FIG. 12 is a schematic sectional view taken along line VII-VII of FIG. 10, of a preferred embodiment of reciprocating conveyor utilizing push plates;

FIG. 13 is a schematic sectional view taken along line VIII-VIII of FIG. 10, of a preferred embodiment of reciprocating conveyor utilizing push plates, with push plates in a rearward motion;

FIG. 14 is a schematic sectional view taken along line VIII-VIII of FIG. 10, of a preferred embodiment of reciprocating conveyor utilizing push plates, with push plates in a forward motion;

FIG. 15 is a schematic cross sectional view of another embodiment of reciprocating conveyor utilizing push plates, with push plates in a rearward motion;

FIG. 16 is a schematic sectional view of another embodiment of reciprocating conveyor utilizing push plates, with push plates in a rearward motion;

FIG. 17 is a schematic sectional view of another embodiment of reciprocating conveyor utilizing push plates, with push plates in a forward motion;

FIG. 18 is a schematic sectional view of yet another embodiment of reciprocating conveyor utilizing push plates, with push plates in a rearward motion;

FIG. 19 is a schematic sectional view of yet another embodiment of reciprocating conveyor utilizing push plates, with push plates in a forward motion;

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG's 1 through 8, a remote mining machine 1 excavates mineral in the mine opening 2 within a seam 3. The mining machine 1 discharges the excavated material onto the receiving module 4 of the self-propelled conveying

assembly 5. The self-propelled conveying assembly 5 consists of the receiving module 4, a plurality of intermediate modules 6 and a drive module 7. The mining machine 1 is connected to the receiving module 4 with advancing cylinders 12 which are used to advance the mining machine 1 into the mining room 2 and also to directionally steer it. The receiving module 4 also carries side jacks 8. Side jacks 8 are normally used for steering the receiving module 4 within the mine opening 2. However, if the mining machine 1 is trapped by a rock fall, the side jacks 8 are braced between the walls 9 of the mine opening 2 and cylinders 12 are used to extract the mining machine 1 from under the rock fall. Where necessary, the receiving module 4 carries a feeder 10 and a breaker 11.

A very important aspect of this invention is the manner in which the self-propelled conveying assembly 5 advances into the mine opening 2 excavated by the mining machine 1. Unlike other systems currently in use, all modules of the conveying assembly 5, including all the intermediate modules 6 and the receiving module 4 have each one or more driven axles 13 capable of generating a traction force to propel the conveying assembly either forward or backward. Driven axles 13 receive power from one or more drive shafts 14 driven from the drive module 7 located on the mining platform 15, through drives 16. As all the driven axles 13 are interconnected through the drive shafts 14, they are forced to advance or retreat at the same speed, regardless of the torque they may require. The whole conveying assembly 5 advances or retreats at the same speed without any appreciable push or pull within the said conveying assembly 5, thus assuring a uniform and problem-free advance or retreat.

In the preferred embodiment of the present invention, the individual conveyors 17 mounted within the intermediate modules 6 and the feeder 10 of the receiving

module 4 also receive power from at least one drive shaft 18 driven from the drive module 7 located on the mining platform 15, through drives 19.

The drive car 7 includes tram power drives 20 that power the drive shafts 14 and conveyor power drives 21 that power the drive shafts 18.

During the advancing or retrieval operation, all components of the conveying assembly 5 including the drive module 7, the intermediate modules 6 and the receiving module 4 are coupled together by couplings 22 while the drive shafts 14 are coupled together by drive couplings 23 and drive shafts 18 are coupled by drive couplings 24. When the intermediate modules 6 are coupled, the head ends 25 and the tail ends 25A of the conveyors 17 overlap in order to facilitate transfer of the aggregate material 26.

The mining platform 15 includes a discharge conveyor 27, the drive module 7, cable and hose winders 28, winches 29, a control room 30, an electrical room 31, a retractable ramp 32, and other required equipment and facilities. The retractable ramp 32 accommodates the elevation difference between the bottom deck 33 of the platform 15 and the bottom 34 of the seam 3. Tracks 35 or other means of propel are provided to facilitate positioning of the mining platform 15 with respect to the mine opening 2.

An important aspect of this invention is the method and apparatus of adding intermediate modules 6 to the conveying assembly 5. The extended bottom deck 33 includes a sliding table 36. A cargo handling equipment such as a commonly available fork lift or a front-end loader is used to deposit an intermediate module 6 onto the sliding table 36. When the conveying assembly 5 advances into the mine opening 2 a full length of one intermediate module 6, the drive module 7 is disconnected from the last rearward intermediate module 6 and moved toward the discharge end 37 of the

discharge conveyor 27, by a moving mechanism 38 attached to the drive module 7, thus generating a gap in the conveying assembly 5 that is greater than the length of on intermediate module 6. The sliding table 36 with an intermediate module 6 is moved sideways until the intermediate module 6 is lined up with the conveying assembly 5 at which point the drive module 7 is moved toward the new intermediate module 6 and all the components of the conveying assembly 5 are reconnected. As the drive shafts 14 and 19 are also reconnected through couplings 23 and 24, all axles 13 and conveyors 17 are powered and begin operating.

The intermediate modules 6 contain protective plates 39, 40 and 41 in order to protect mechanical and electrical components of the conveying assembly 5, including conveyor 17, electrical cables 42 and hoses 43. For this purpose, the electrical cables 42 and the hoses 43 and laid into structural trays 44. The sides 45 of the structural trays 44 also perform a function of guiding the conveying assembly 5 within the walls 9 of the mine opening 2.

Referring to FIG. 9, chain conveyors 46 are mounted within the intermediate modules 6. The chain 47 includes flights 48 that swing downwards by gravity when they travel in the direction of transport shown by an arrow 49 and push the aggregate material 50 within the intermediate module 6. In order to make the conveyors 46 more space efficient, a cam 51 swings the flights 48 to a horizontal position during their return path shown by an arrow 52.

FIG.s 10 through 14 show a schematic of the intermediate modules 6 with a reciprocating conveyor 53. Each module 6 contains a section 54 of a reciprocating conveyor 53. Each section 54 contains flights 55 with transverse shafts 56, rollers 57 that run in guides 58, supporting rollers 59 and a longitudinal shaft 60. The shafts 60 of sections 54 are connected by couplings 61 and form a single shaft connected to a

reciprocating mechanism mounted on the drive module 7 located on the mining platform 15. When the flights 55 are moved in the direction of transport designated by an arrow 62, they swing into a substantially vertical position and push the granular material 50 within the intermediate module 6 in the direction of transport. When the flights 55 are moved in the opposite direction, they swing into a substantially horizontal position by the resistance of the aggregate material 26 and return without pushing the aggregate material 50.

FIG.s 15 through 17 show a schematic of the intermediate modules 6 with another embodiment of a reciprocating conveyor 62 containing flights 63 with rollers 64 that run in guides 65 longitudinal linkages 66. When the flights 63 are moved in the direction of transport designated by an arrow 67, they swing into a substantially vertical position and push the granular material 50 within the intermediate module 6 in the direction of transport. When the flights 63 are moved in the opposite direction, they swing into a substantially horizontal position by the resistance of the aggregate material 50 and return without pushing the aggregate material 50.

FIG.s 18 and 19 show a schematic of the intermediate modules 6 with yet another embodiment of a reciprocating conveyor. In this embodiment, flights 68 are moved into a substantially vertical position when moving in the direction of transport and into a substantially horizontal position when moving in an opposite direction by cams 69 moving within guides 70.

WE CLAIM

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

What is claimed is

1. A method of remote mining aggregate material from a seam utilizing mining means and a self-propelled conveying means, comprising the steps of:

remotely excavating aggregate material from the said seam;

remotely conveying the said aggregate material from the said seam by a self-propelled conveying means to a suitable location;

connecting the said mining means to the said self-propelled conveying means by an independent advancing means;

advancing the said mining means into the said seam by advancing the said mining means from the forward end of the said self-propelled conveying means utilizing the said independent advancing means;

aligning and steering the said mining means utilizing the said independent advancing means;

advancing the said self-propelled conveying means into the said seam independently of the mining means by a self-propelling means;

guiding the said self-propelled conveying means within the mine opening by locating structural rails within a predetermined distance from the walls of the said mine opening.

2. The method according to claim 1, where the tractive force required for advancing of the said self-propelled conveying means is provided at substantially regular intervals along the length of the self-propelled conveying means.

3. The method according to claim **2**, where the said tractive force is provided by powered wheels engaged with a ground.

4. The method according to claim **1**, where the said conveying of aggregate material is done by an interconnected conveying means having a common drive means and comprised of individual modules connected to form a train.

5. The method according to claim **1**, where the said conveying of aggregate material is done by a conveying means comprised of individual conveyors connected to form a train.

6. A method of remote mining aggregate material from a seam utilizing mining means and a self-propelled conveying means, comprising the steps of:

remotely excavating aggregate material from the said seam;

remotely conveying the said aggregate material from the said seam by a self-propelled conveying means to a suitable location;

connecting the said mining means to the said self-propelled conveying means by a steering means;

aligning and steering said mining means utilizing the said steering means.

advancing the said self-propelled conveying means by a self-propelling means;

advancing the said mining means into the said seam by the forward motion of the said self-propelled conveying means;

guiding the said self-propelled conveying means within the mine opening by locating structural rails within a predetermined distance from the walls of the said mine opening.

7. The method according to claim 6, where the tractive force required for advancing of the said self-propelled conveying means is provided at substantially regular intervals along the length of the self-propelled conveying means.

8. The method according to claim 7, where the said tractive force is provided by powered wheels engaged with a ground.

9. The method according to claim 6, where the said conveying of aggregate material is done by an interconnected conveying means having a common drive means and comprised of individual modules connected to form a train.

10. The method according to claim 6, where said conveying of aggregate material is done by a conveying means comprised of individual conveyors connected to form a train.

11. A method of remote mining aggregate material from a seam utilizing mining means and a self-propelled conveying means, comprising the steps of:

remotely excavating aggregate material from the said seam;

remotely conveying the said aggregate material from the said seam by a self-propelled conveying means to a suitable location;

connecting the said mining means to an independent advancing means;

advancing the said mining means into the said seam independently of the said self-propelled conveying means by the said independent advancing means;

aligning and steering the said mining means utilizing the said independent advancing means;

advancing the said self-propelled conveying means into the said seam independently of the mining means by a self-propelling means;

guiding the said self-propelled conveying means within the mine opening by locating structural rails within a predetermined distance from the walls of the said mine opening.

12. The method according to claim 11, where the tractive force required for advancing of the said conveying means is provided at substantially regular intervals along the length of the self-propelled conveying means.

13. The method according to claim 12, where the said tractive force is provided by powered wheels engaged with a ground.

14. The method according to claim 11, where the said conveying of aggregate material is done by an interconnected conveying means having a common drive means and comprised of individual modules connected to form a train.

15. The method according to claim 11, where the said conveying of aggregate material is done by a conveying means comprised of individual conveyors connected to form a train.

16. An apparatus for remote mining of aggregate material from a seam, comprising:

mining means for remote excavating of aggregate material from the said seam;

means for remote conveying of the said aggregate material capable of propelling itself in and out of the said seam on its own power; advancing and steering means for advancing and steering the said mining means into the said seam by advancing the said mining means from the forward end of the said self-propelled conveying means;

assembling and disassembling means for the said conveying means where the individual modules of the said conveying means can be inserted from a predetermined position within the said assembling and disassembling means;

means for receiving said aggregate material from the discharge end of the said conveying means.

17. The apparatus according to claim 16, where the propelling of the said conveying means is provided by a plurality of tractive means spaced at substantially regular intervals along the length of the said conveying means.

18. The apparatus according to claim 17, where the said tractive means comprises powered wheels engaged with a ground.

19. The apparatus according to claim 18, where the power for the said powered wheels is provided by one ore more drive shafts having a power input at the rearward end of the conveying means.

20. The apparatus according to claim 18, where the power for the said powered wheels is provided by one ore more drive shafts having a power input at the rearward end and the forward end of the conveying means.

21. The apparatus according to claim 18, where the power for the said powered wheels is provided by one ore more drive shafts having a power input the at multiple locations along the conveying means.

22. The apparatus according to claim 18, where the said powered wheels have independent power drives.

23. The apparatus according to claim 16, where the said conveying means is an interconnected conveyor having a common drive and consisting of a plurality of individual modules connected to form a train.

24. The apparatus according to claim 16, where the said conveying means consists of a plurality of individual conveyors connected to form a train.

25. The apparatus according to claim 16, where the power input for the individual conveyors is a continuous drive shaft with a power input at either one or both ends of the said conveying means. .

26. The apparatus according to claim 16, where each individual conveyor has an independent power drive. .

27. The apparatus according to claim 16, where the conveying means, cables and services are protected from rock falls by a protective cover. .

28. The apparatus according to claim 16, where the said assembling and disassembling means includes a retractable ramp for the said conveying means to advance from the said assembling means to the seam and back. .

29. The apparatus according to claim 16, where the said advancing and steering means of the said mining means is capable of pulling the mining means from under the caved rock. .

30. The apparatus according to claim 16, where the said conveying means includes guides located within a predetermined distance from the walls of the said mine opening. .

31. An apparatus for remote mining of aggregate material from a seam, comprising:

mining means for remote excavating of aggregate material from the said seam;

means for remote conveying of the said aggregate material capable of propelling itself in and out of the said seam on its own power;

steering means for steering the said mining means attached to the forward end of the said self-propelled conveying means;

assembling and disassembling means for the said conveying means where the individual modules of the said conveying means can be inserted from a predetermined position within the said assembling and disassembling means;

means for receiving said aggregate material from the discharge end of the said conveying means.

32. The apparatus according to claim 31, where the propelling of the said conveying means is provided by a plurality of tractive means spaced at substantially regular intervals along the length of the said conveying means. .

33. The apparatus according to claim 32, where the said tractive means comprises powered wheels engaged with a ground. .

34. The apparatus according to claim 33, where the power for the said powered wheels is provided by one ore more drive shafts having a power input at the rearward end of the conveying means. .

35. The apparatus according to claim 33, where the power for the said powered wheels is provided by one ore more drive shafts having a power input at the rearward end and the forward end of the conveying means. .

36. The apparatus according to claim 33, where the power for the said powered wheels is provided by one ore more drive shafts having a power input the at multiple locations along the conveying means. .

37. The apparatus according to claim 33, where the said powered wheels have independent power drives. .

38. The apparatus according to claim 31, where the said conveying means is an interconnected conveyor having a common drive and consisting of a plurality of individual modules connected to form a train. .

39. The apparatus according to claim 31, where the said conveying means consists of a plurality of individual conveyors connected to form a train. .

40. The apparatus according to claim 31, where the power input for the individual conveyors is a continuous drive shaft with a power input at either one or both ends of the said conveying means. .

41. The apparatus according to claim 31, where each individual conveyor has an independent power drive. .

42. The apparatus according to claim 31, where the conveying means, cables and services are protected from rock falls by a protective cover. .

43. The apparatus according to claim 31, where the said assembling and disassembling means includes a retractable ramp to enable the said conveying means to advance from the said assembling means to the said seam. .

44. The apparatus according to claim 31, where the said steering means of the said mining means is capable of pulling the mining means from under the caved rock. .

45. The apparatus according to claim 31, where the said conveying means includes guides located within a predetermined distance from the walls of the said mine opening. .

46. An apparatus for remote mining of aggregate material from a seam, comprising:

mining means for remote excavating of aggregate material from the said seam;

means for remote conveying of the said aggregate material capable of propelling itself and the said mining means in and out of the said seam on its own power;

advancing and steering means for advancing and steering the said mining means into the said seam by advancing the said mining means independently of the said self-propelled conveying means; .

assembling and disassembling means for the said conveying means where the individual modules of the said conveying means can be inserted from a predetermined position within the said assembling and disassembling means;

means for receiving said aggregate material from the discharge end of the said conveying means. .

47. The apparatus according to claim 46, where the propelling of the said conveying means is provided by a plurality of tractive means spaced at substantially regular intervals along the length of the said conveying means. .

48. The apparatus according to claim 47, where the said tractive means comprises powered wheels engaged with a ground. .

49. The apparatus according to claim 48, where the power for the said powered wheels is provided by one ore more drive shafts having a power input at the rearward end of the conveying means. .

50. The apparatus according to claim 48, where the power for the said powered wheels is provided by one ore more drive shafts having a power input at the rearward end and the forward end of the conveying means. .

51. The apparatus according to claim 48, where the power for the said powered wheels is provided by one ore more drive shafts having a power input the at multiple locations along the conveying means.

52. The apparatus according to claim 48, where the said powered wheels have independent power drives. .

53. The apparatus according to claim 46, where the said conveying means is an interconnected conveyor having a common drive and consisting of a plurality of individual modules connected to form a train. .

54. The apparatus according to claim 46, where the said conveying means consists of a plurality of individual conveyors connected to form a train. .

55. The apparatus according to claim 46, where the power input for the individual conveyors is a continuous drive shaft with a power input at either one or both ends of the said conveying means. .

56. The apparatus according to claim 46, where each individual conveyor has an independent power drive. .

57. The apparatus according to claim 46, where the conveying means, cables and services are protected from rock falls by a protective cover. .

58. The apparatus according to claim 46, where the said assembling and disassembling means includes a retractable ramp to enable the said conveying means to advance from the said assembling means to the said seam. .

59. The apparatus according to claim 46, where the said advancing and steering means of the said mining means is capable of pulling the mining means from under the caved rock. .

60. The apparatus according to claim 46, where the said conveying means includes guides located within a predetermined distance from the walls of the said mine opening. .

61. A method of conveying aggregate material comprising of the steps of:

feeding the said aggregate material at the feed end of a longitudinal container;

moving reciprocating plates within the said longitudinal container in the direction of conveying the length of a reciprocating cycle while holding the said plates substantially perpendicular to the direction of conveying;

returning the said reciprocating plates within the said longitudinal container in the direction opposite to the said direction of conveying the length of the said reciprocating cycle while holding the said plates substantially parallel to the direction of conveying;

66. The apparatus for conveying of aggregate material as per Claim 64, where the said reciprocating push plates include cams for holding the said reciprocating push plates in predetermined positions.

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DM TECHNOLOGIES LTD.

David B Fitzpatrick

repeating the said reciprocating cycle at a predetermined frequency in order to achieve a desired conveying capacity;

discharging the aggregate material at the discharge end of the said longitudinal container.

62. The method of conveying according to Claim **61**, where during the conveying part of the said reciprocating cycle the said reciprocating plates are held in a substantially perpendicular position by rollers and during the return part of the said reciprocating cycle the said reciprocating plates are held in a substantially parallel position by the resistance of the said aggregate material. .

63. The method of conveying according to Claim **61**, where the said reciprocating plates are held in a predetermined position by cams. .

64. An apparatus for conveying of aggregate materials comprising:

conveying trough containing the said aggregate material;

reciprocating push plates that advance the aggregate material within the said conveying trough in the direction of conveying when moving in the said direction and swing out of the path of the aggregate material when moving in the opposite direction;

one or more actuating rods attached to the said reciprocating push plates;

reciprocating actuators attached to the said reciprocating push plates at least at one end of the said apparatus. .

65. The apparatus for conveying of aggregate material as per Claim **64**, where the said reciprocating push plates include rollers for holding the said reciprocating push plates in predetermined positions. .

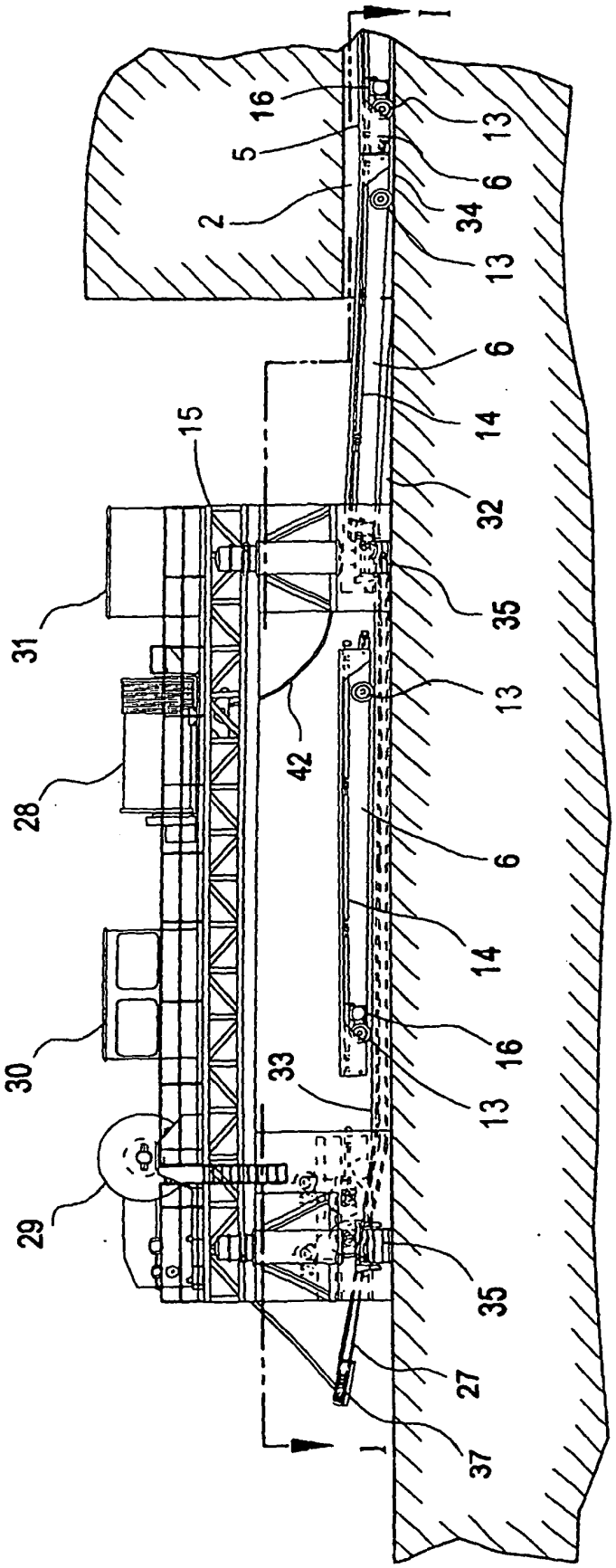

FIG. 1

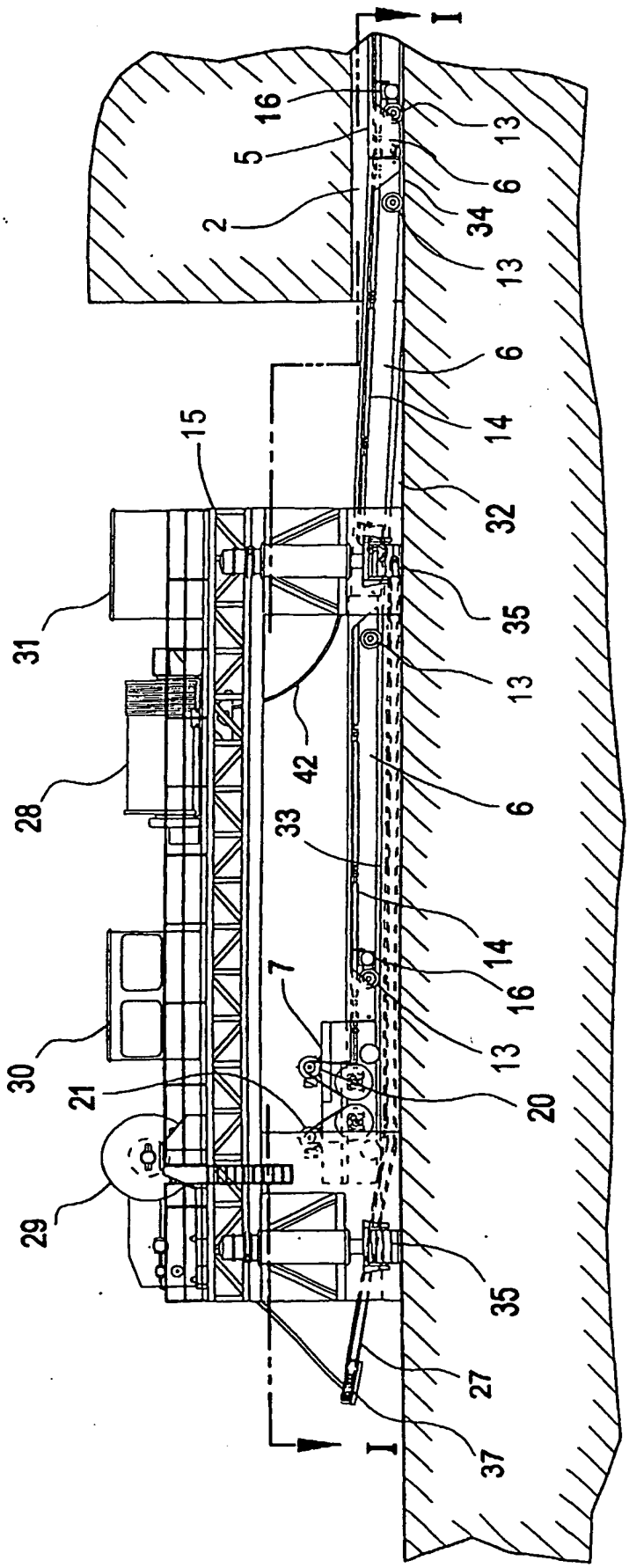
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FIG. 1a

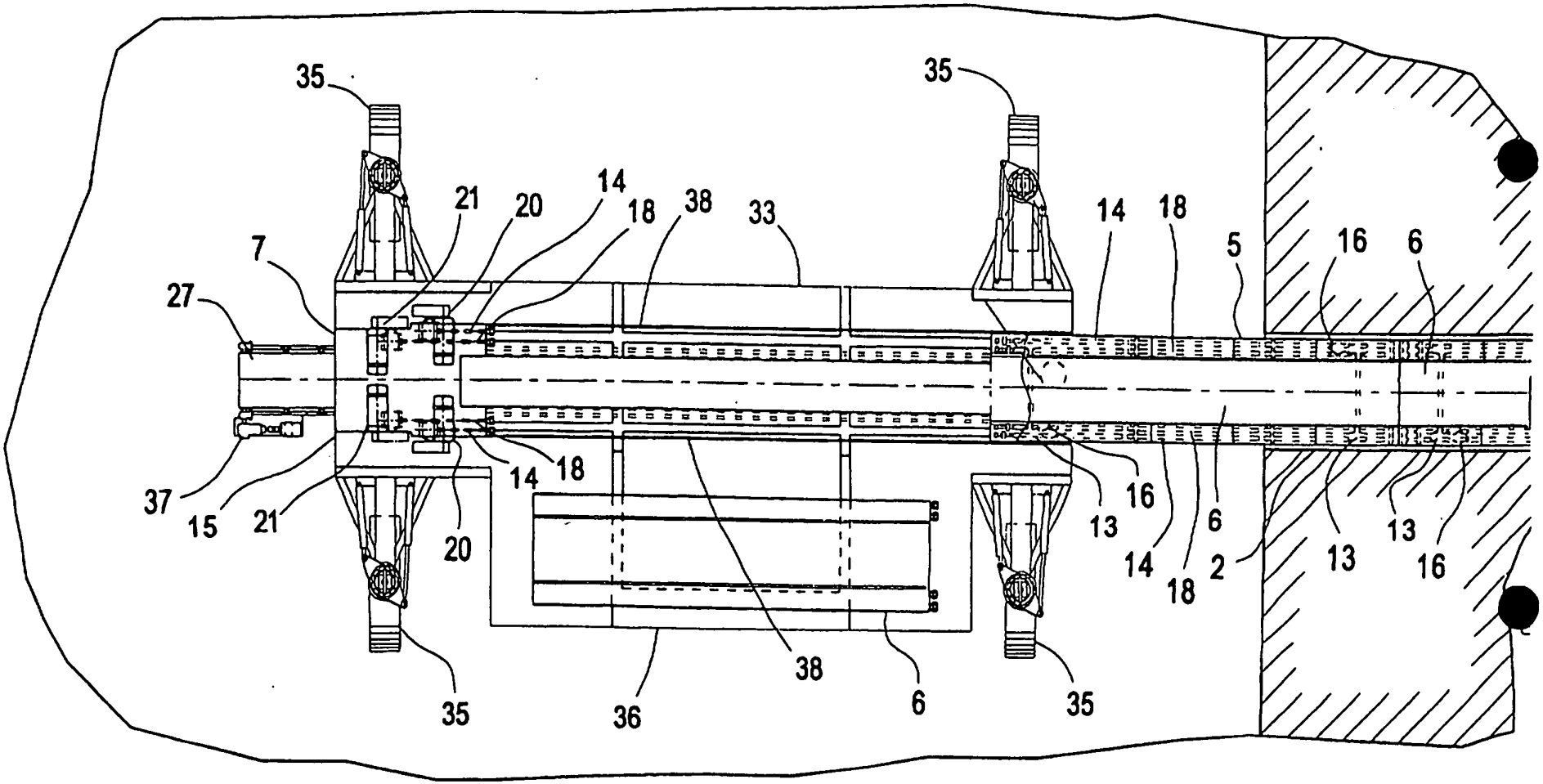
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FIG. 2

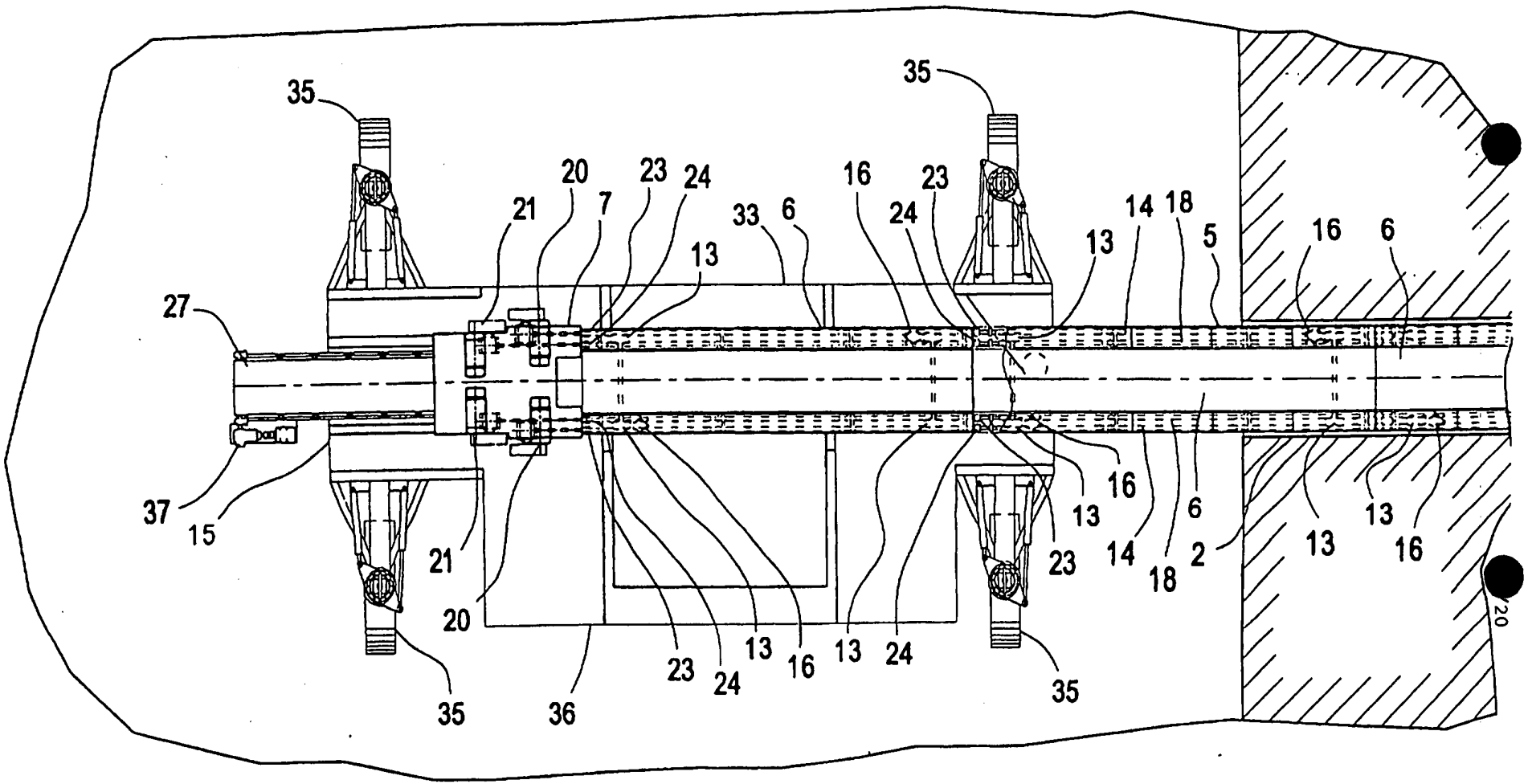
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FIG. 2a

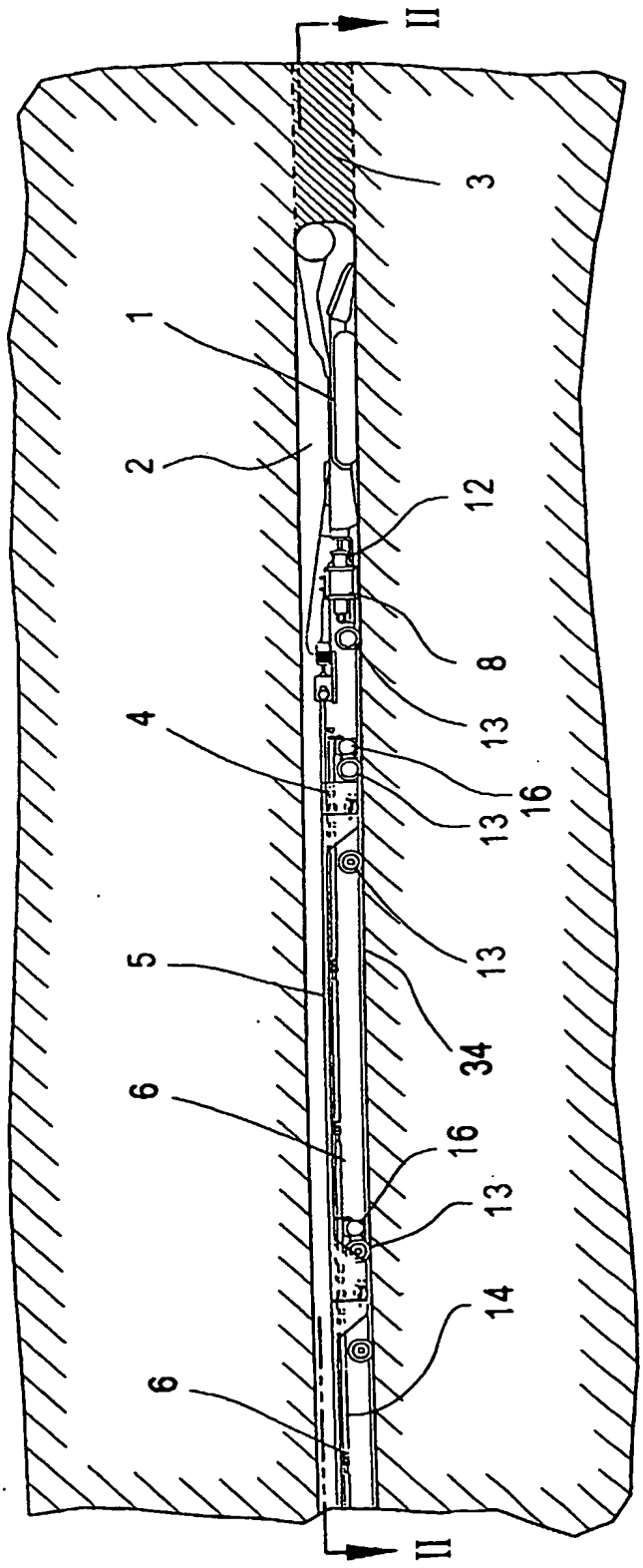

FIG. 3

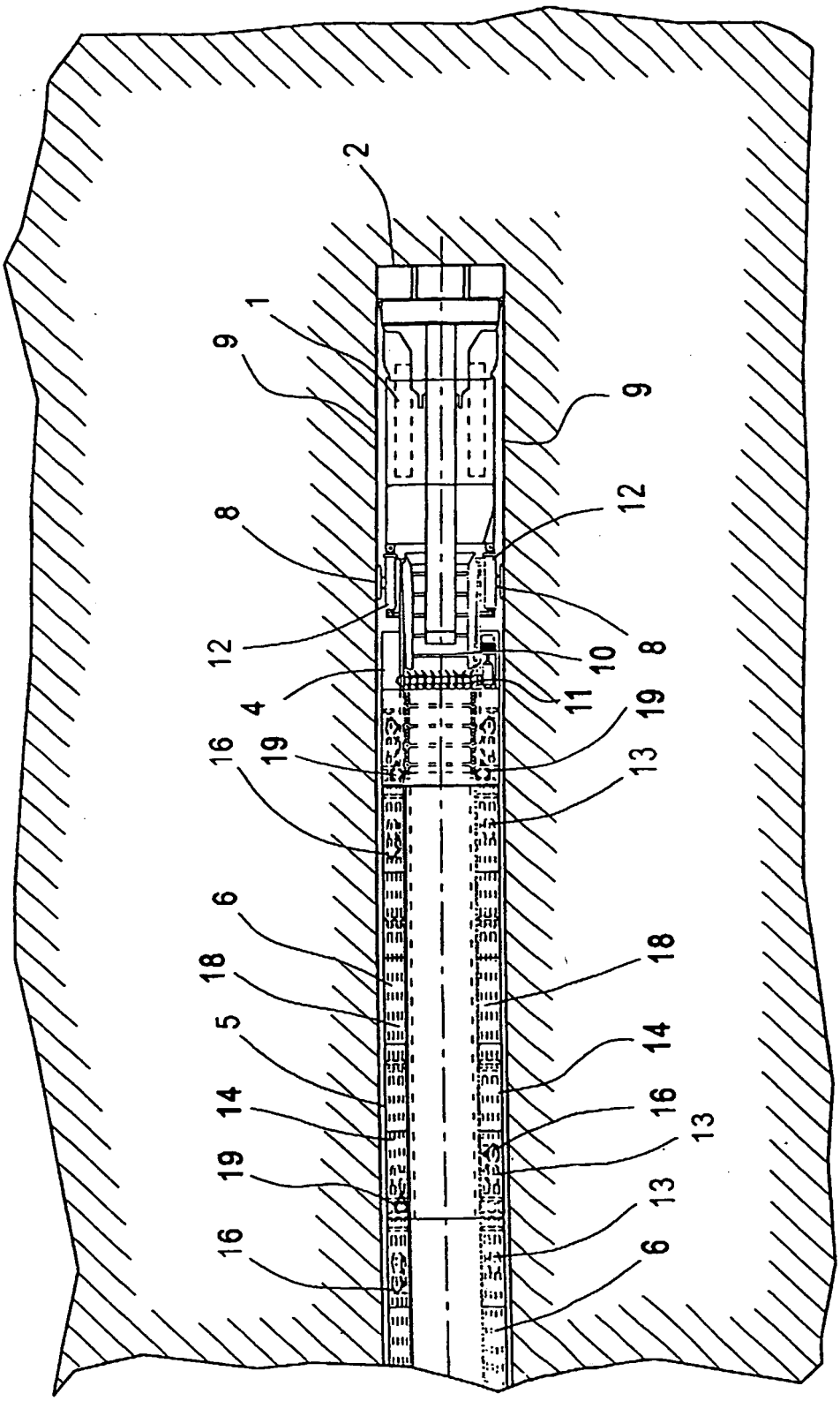

FIG. 4

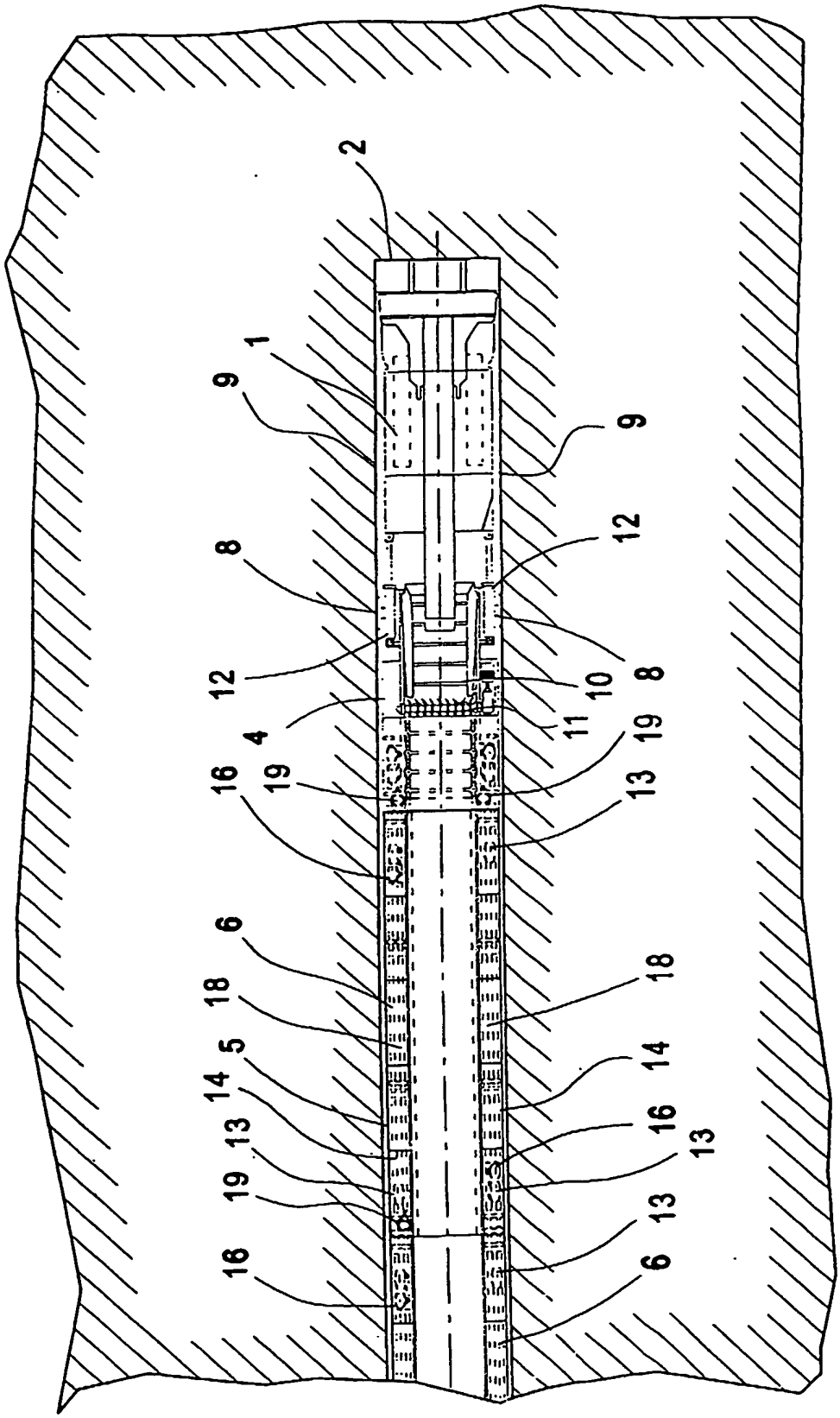

FIG. 4a

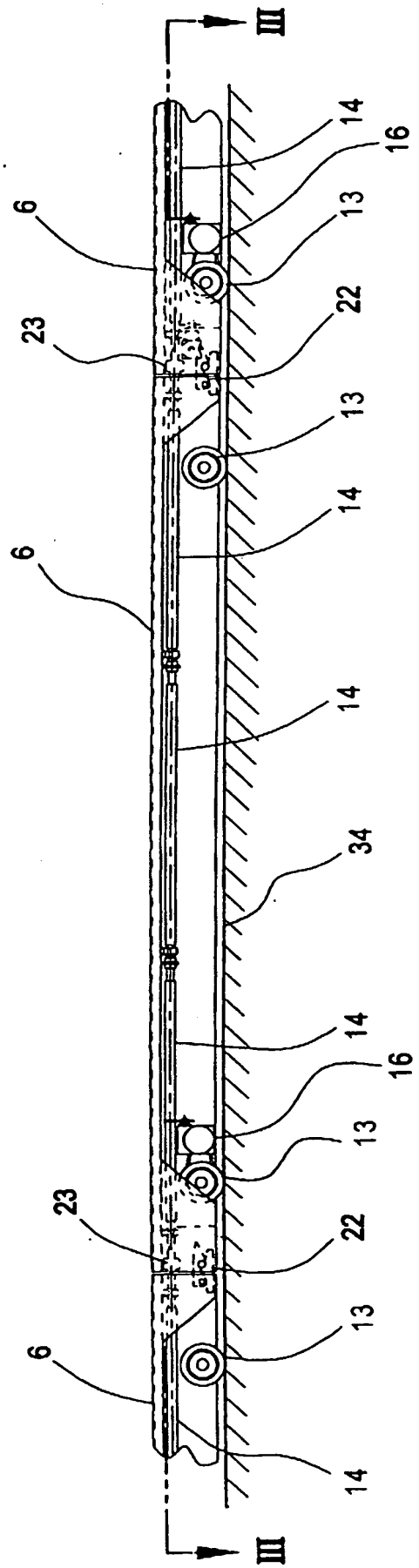

FIG. 5

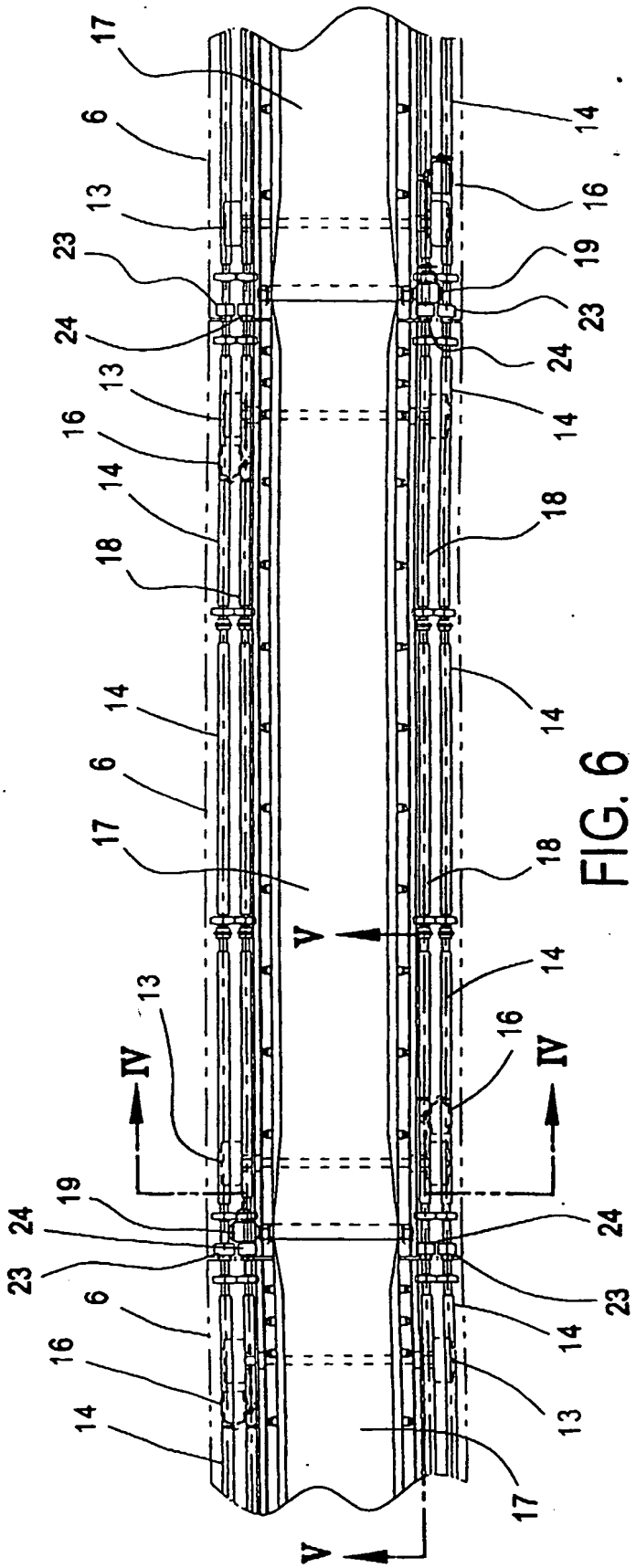

FIG. 6

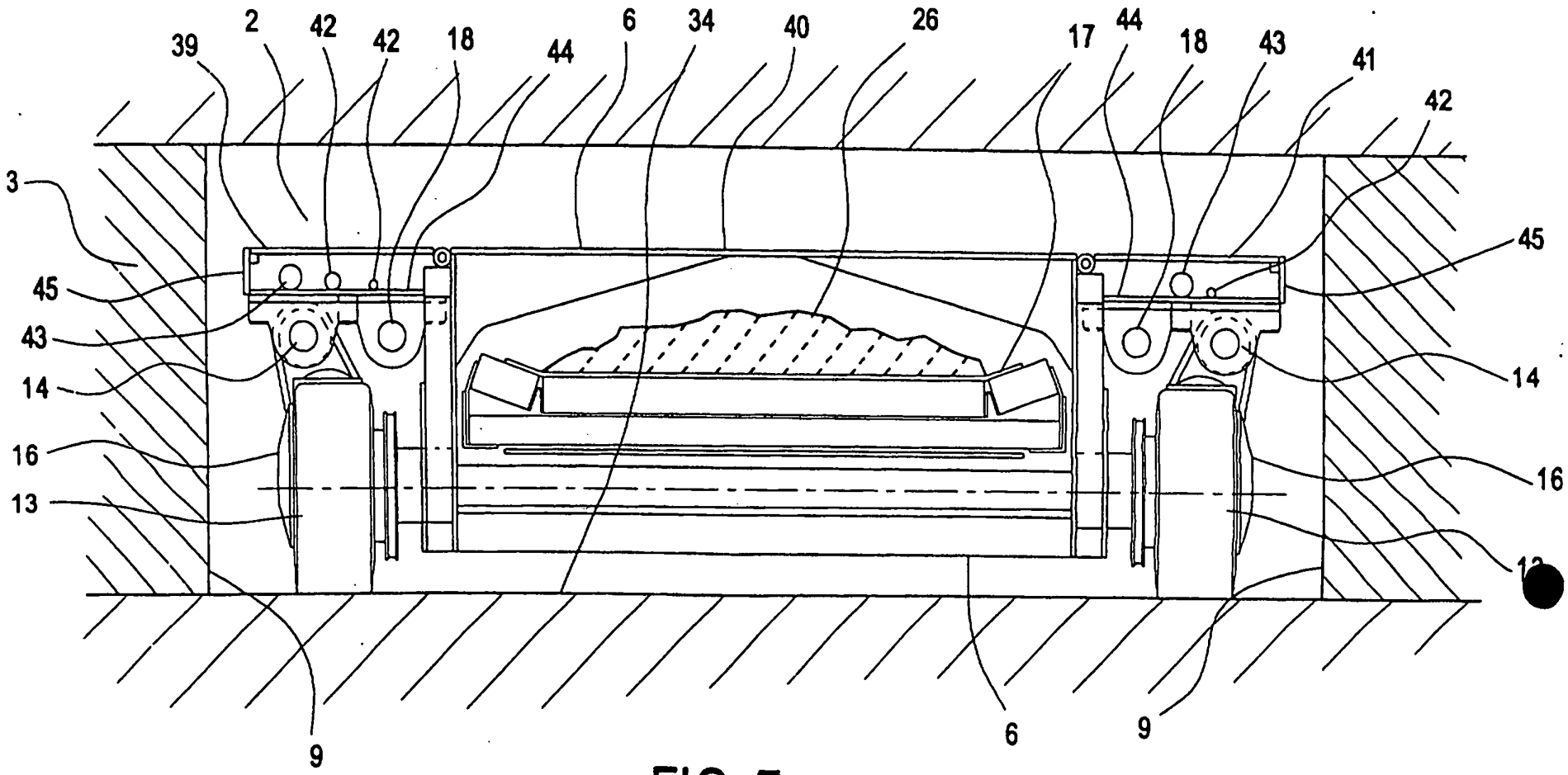
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FIG. 7

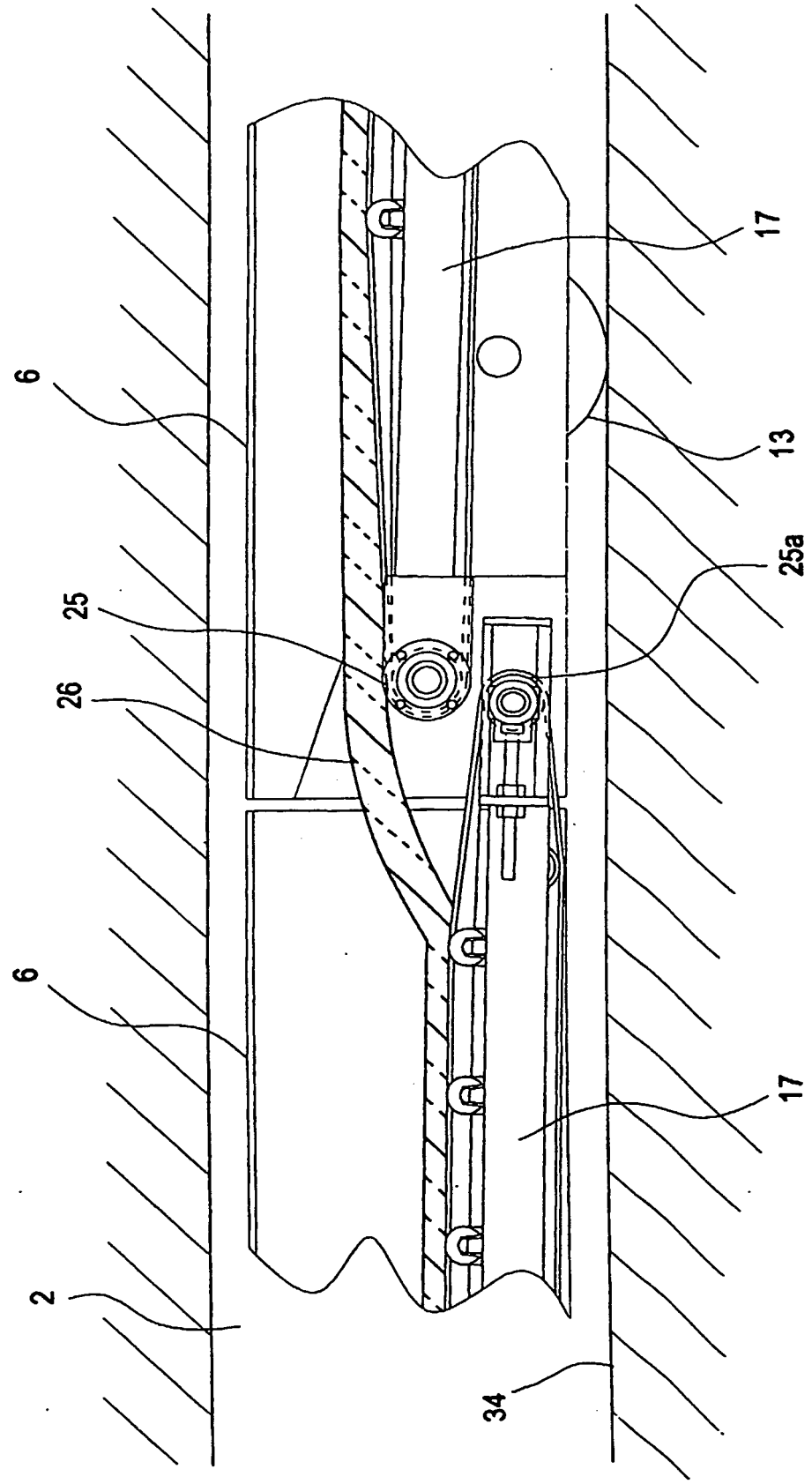

FIG. 8

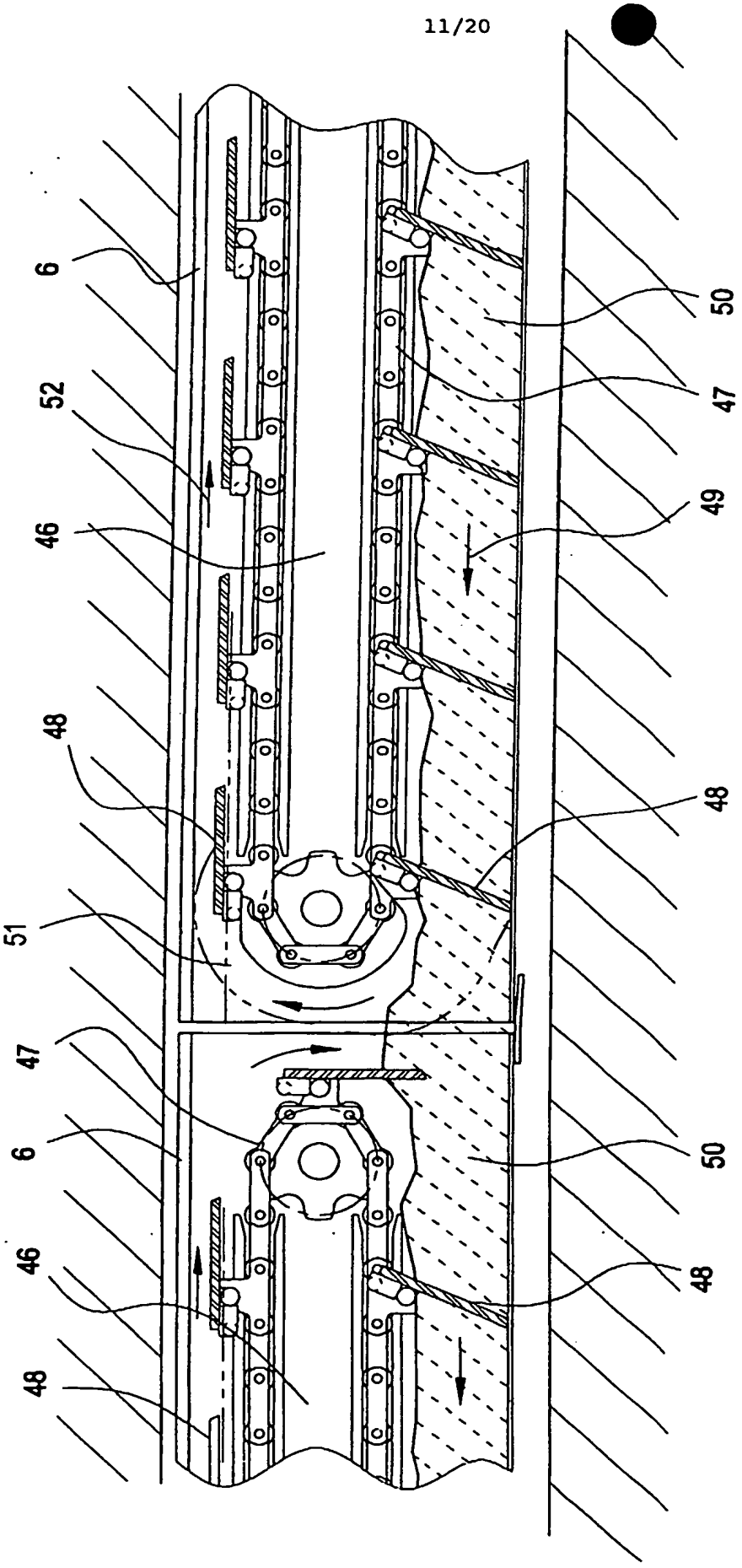

FIG. 9

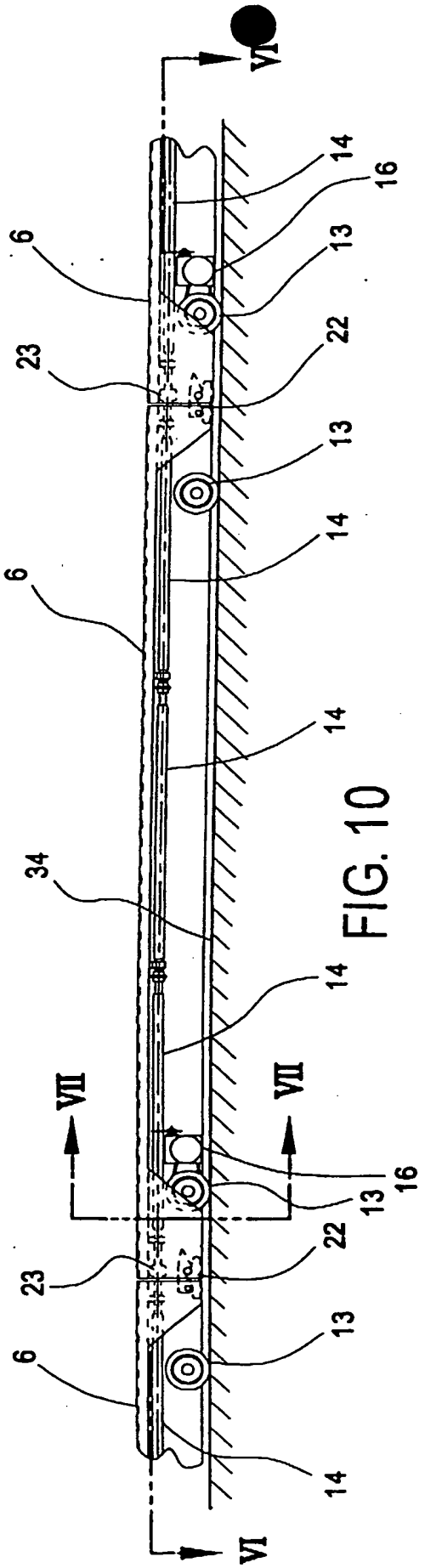
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FIG. 10

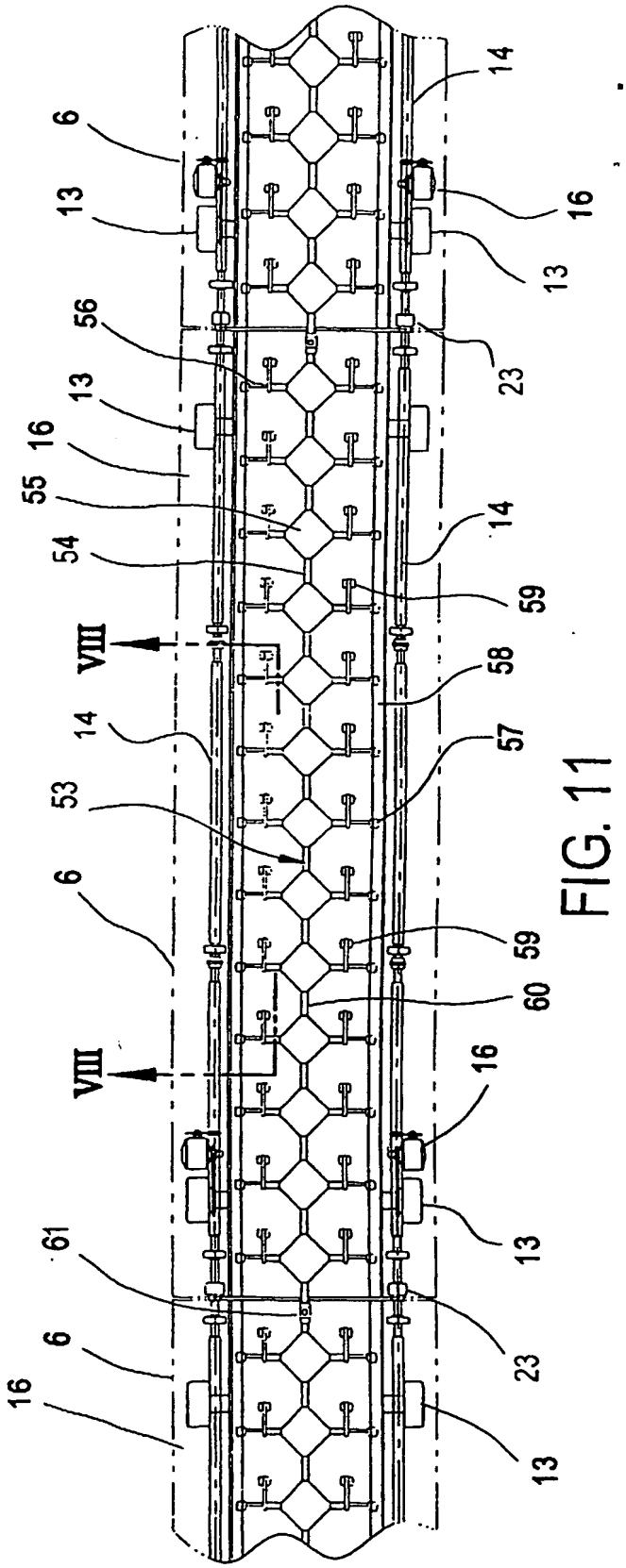
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FIG. 11

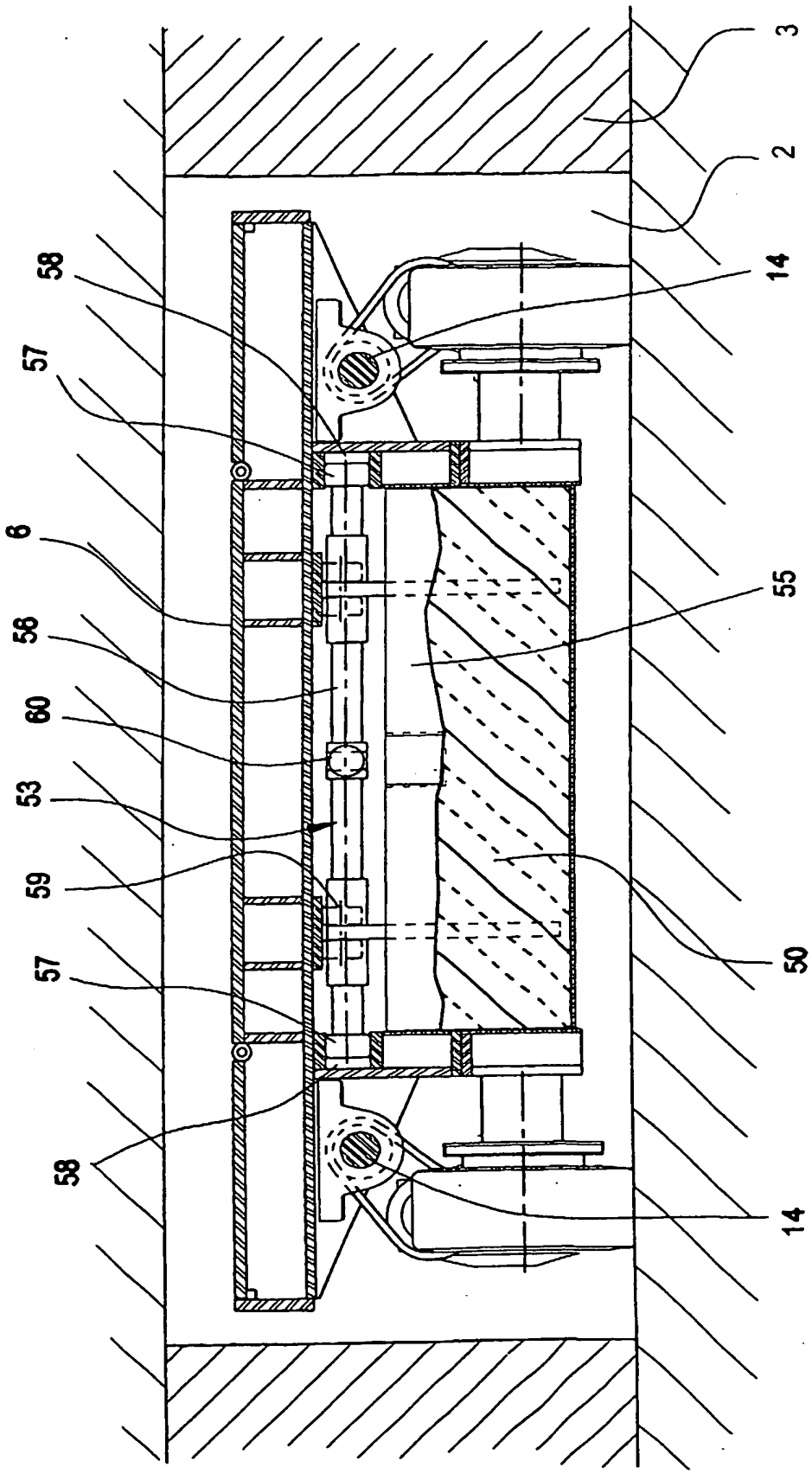

FIG. 12

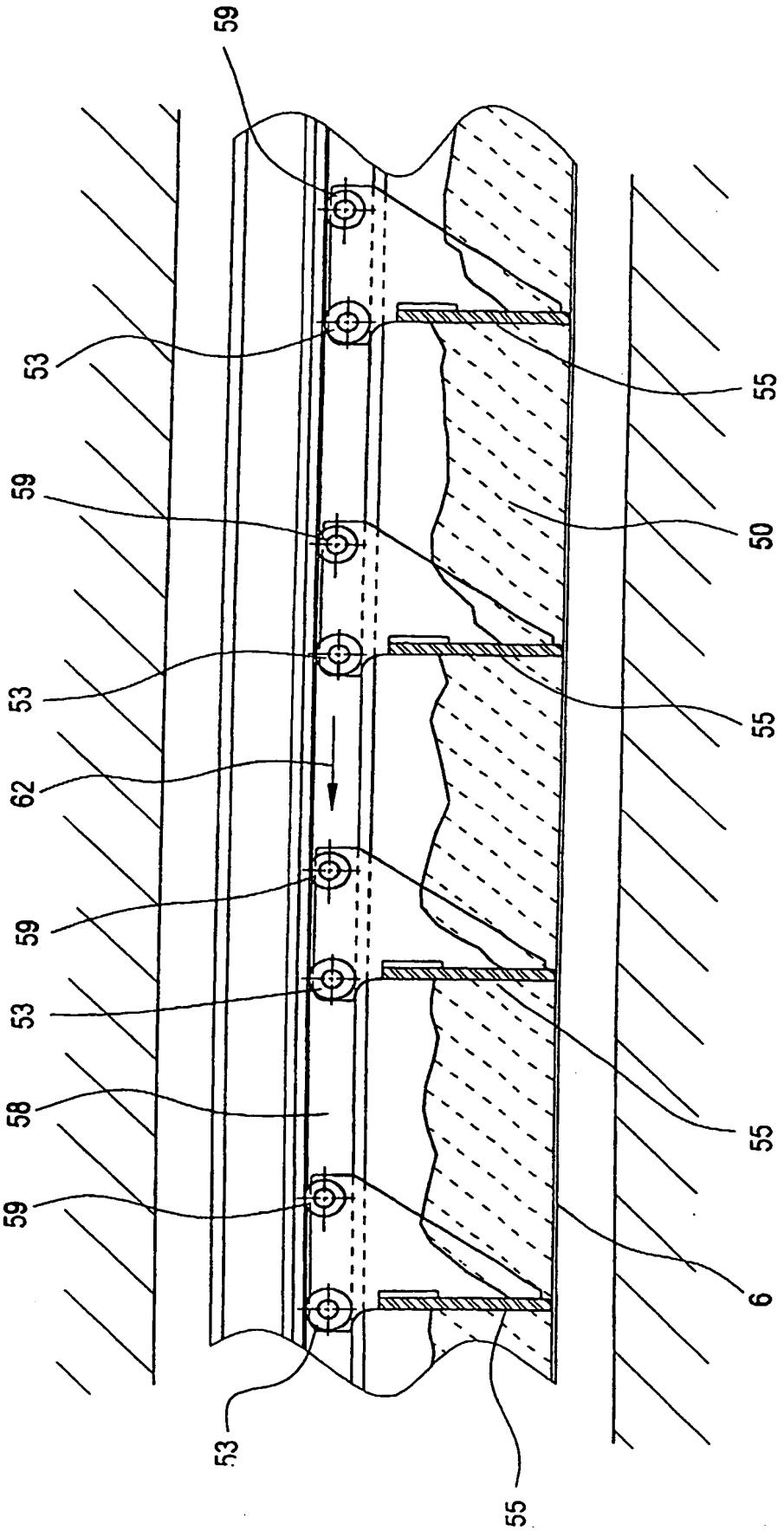

FIG. 13

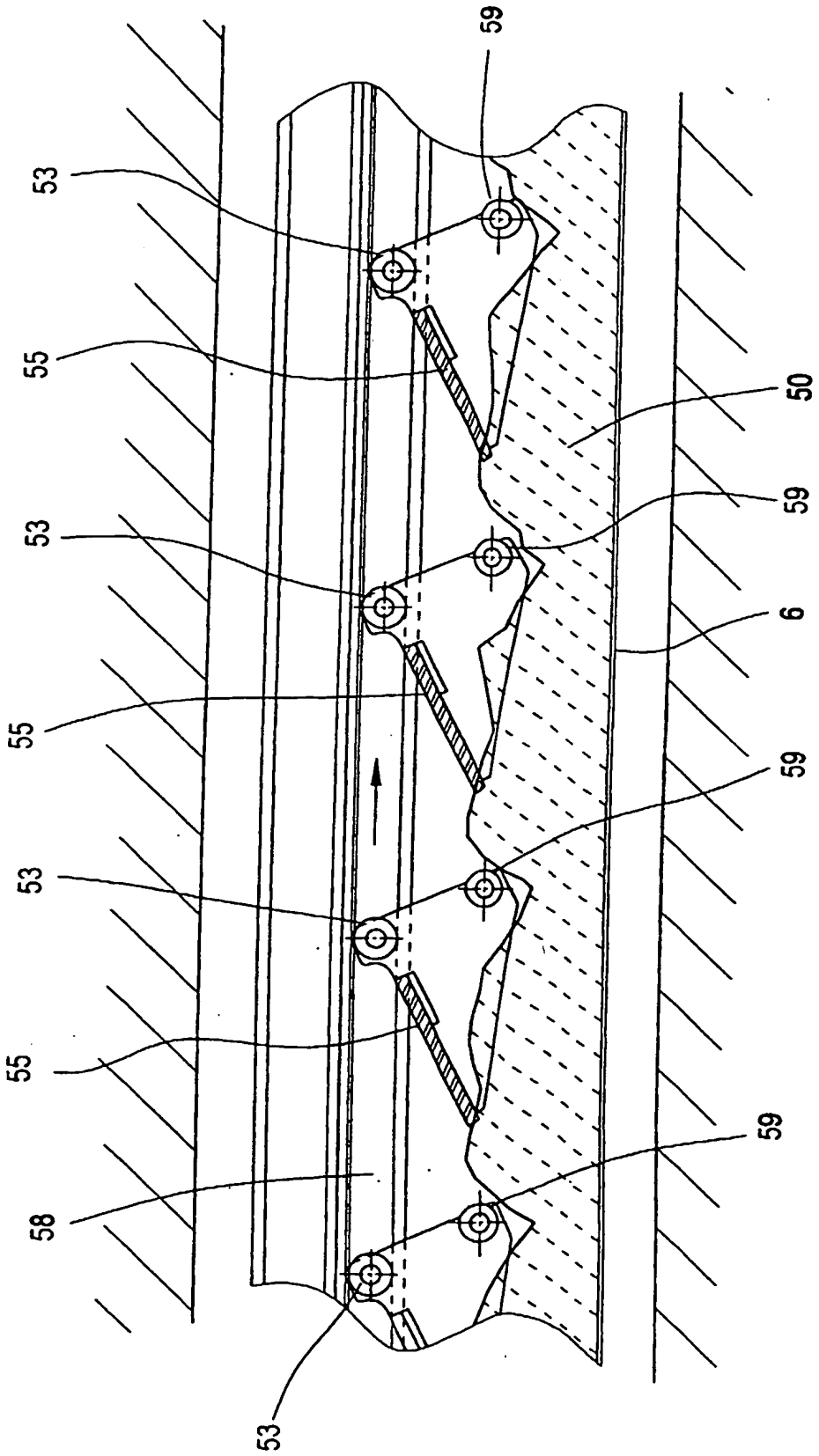

FIG. 14

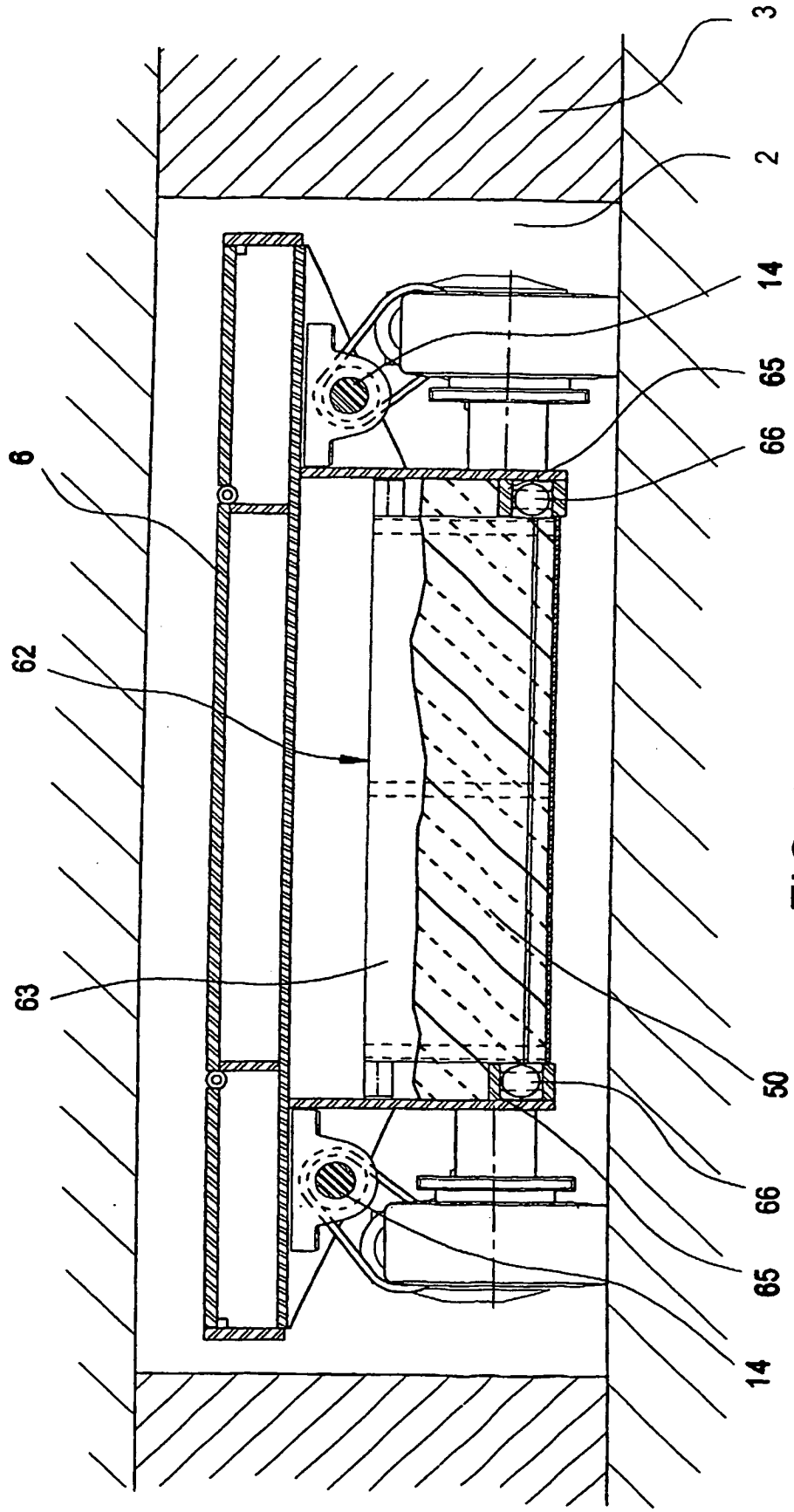

FIG. 15

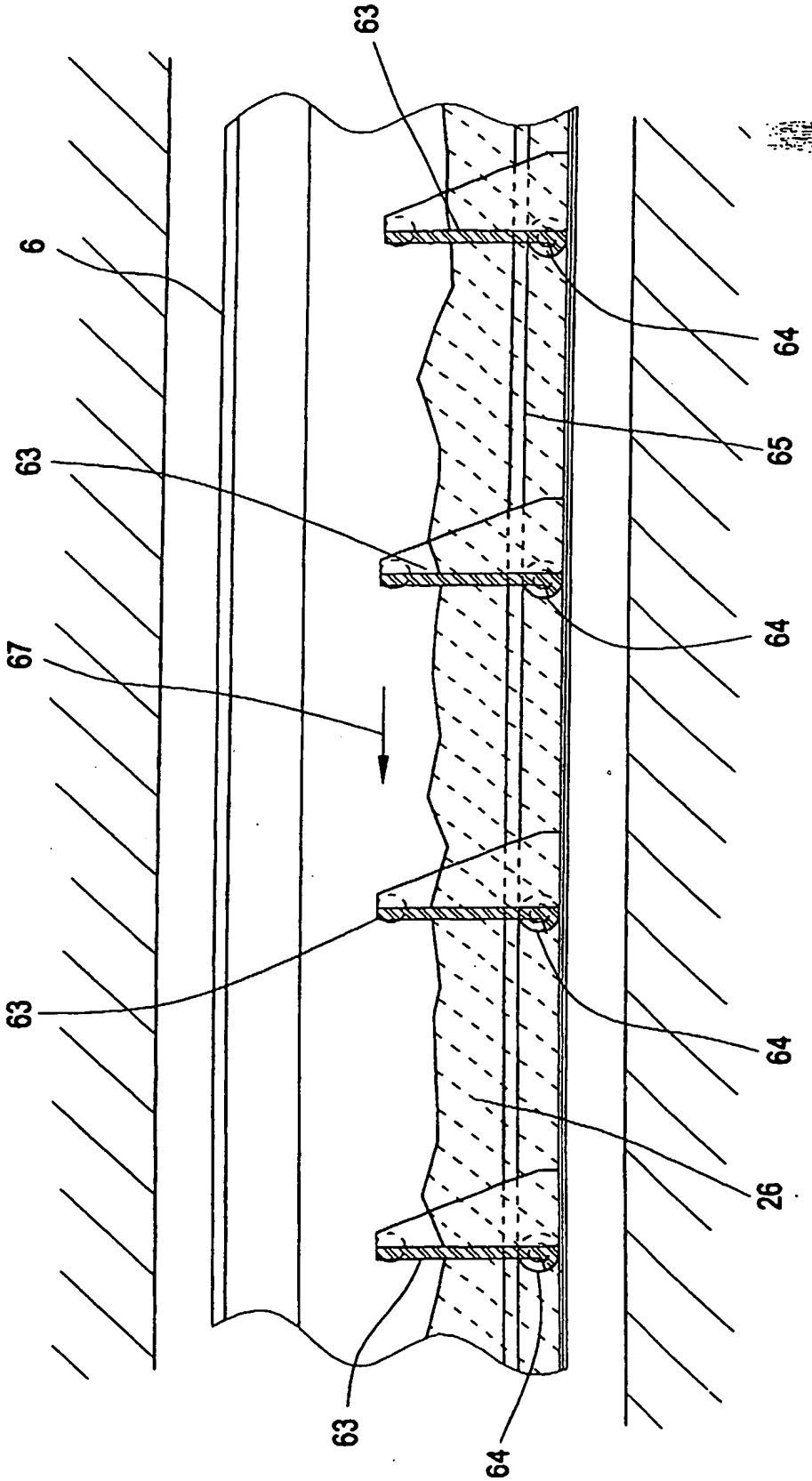

FIG. 16

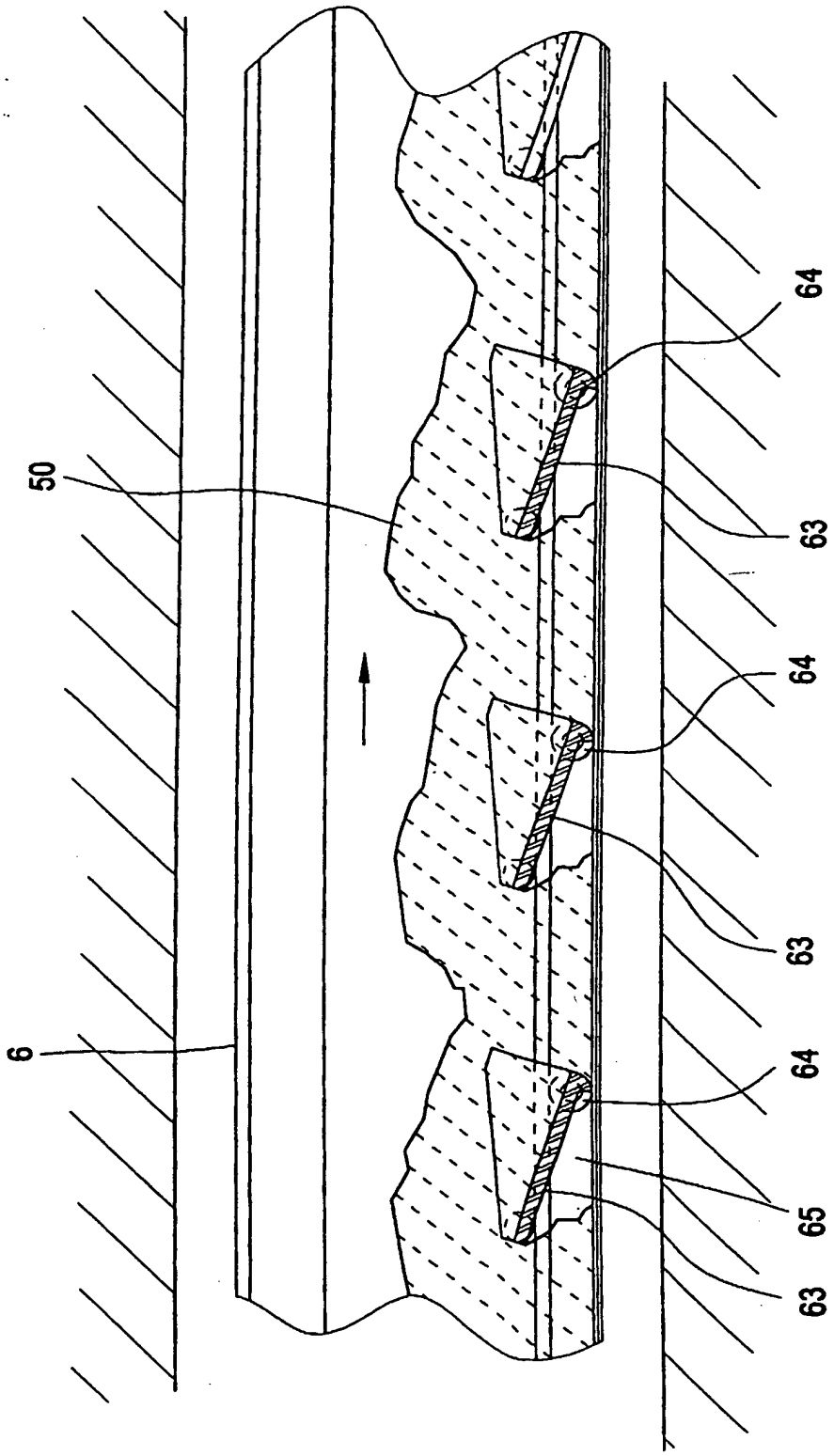

FIG. 17

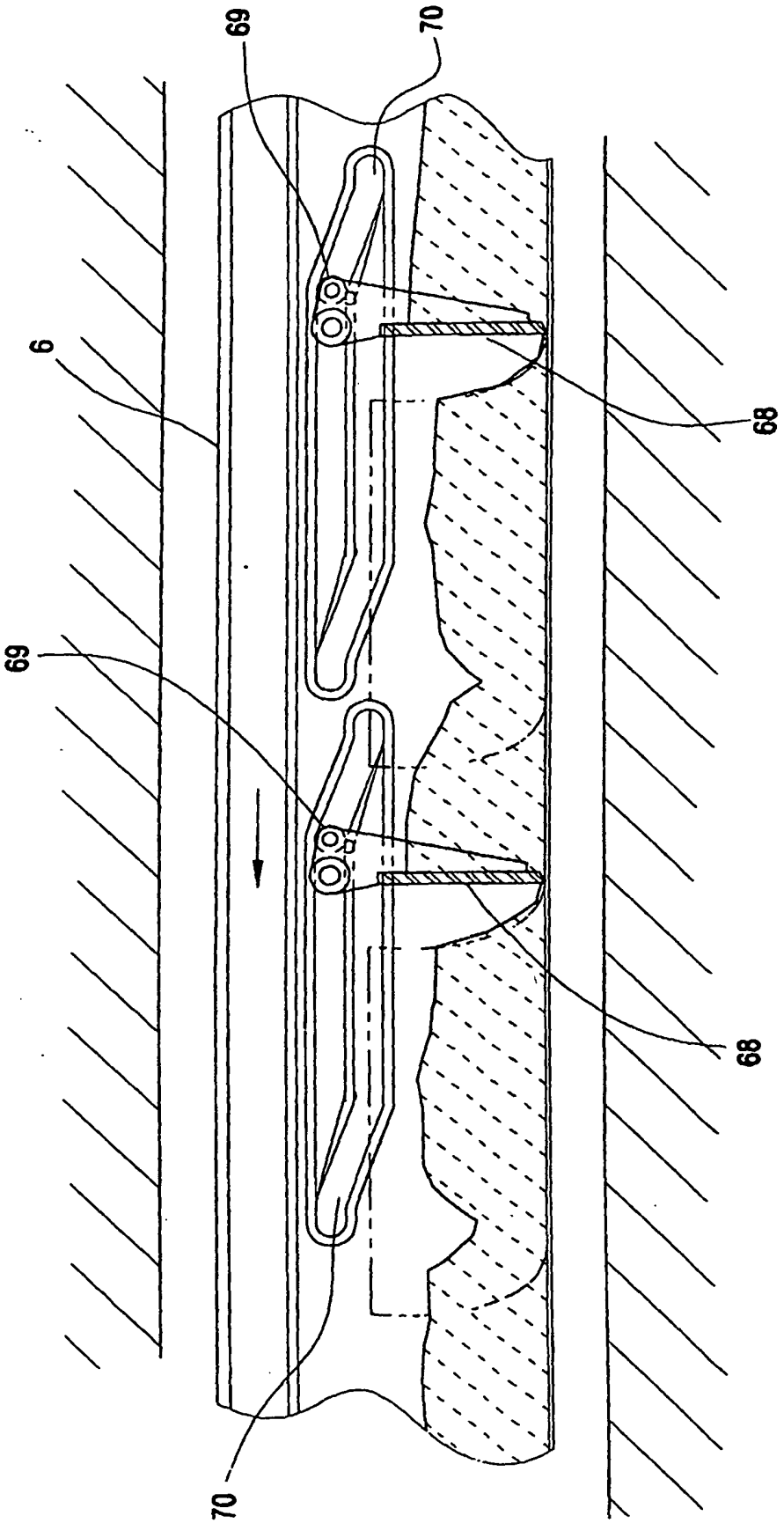

FIG. 18

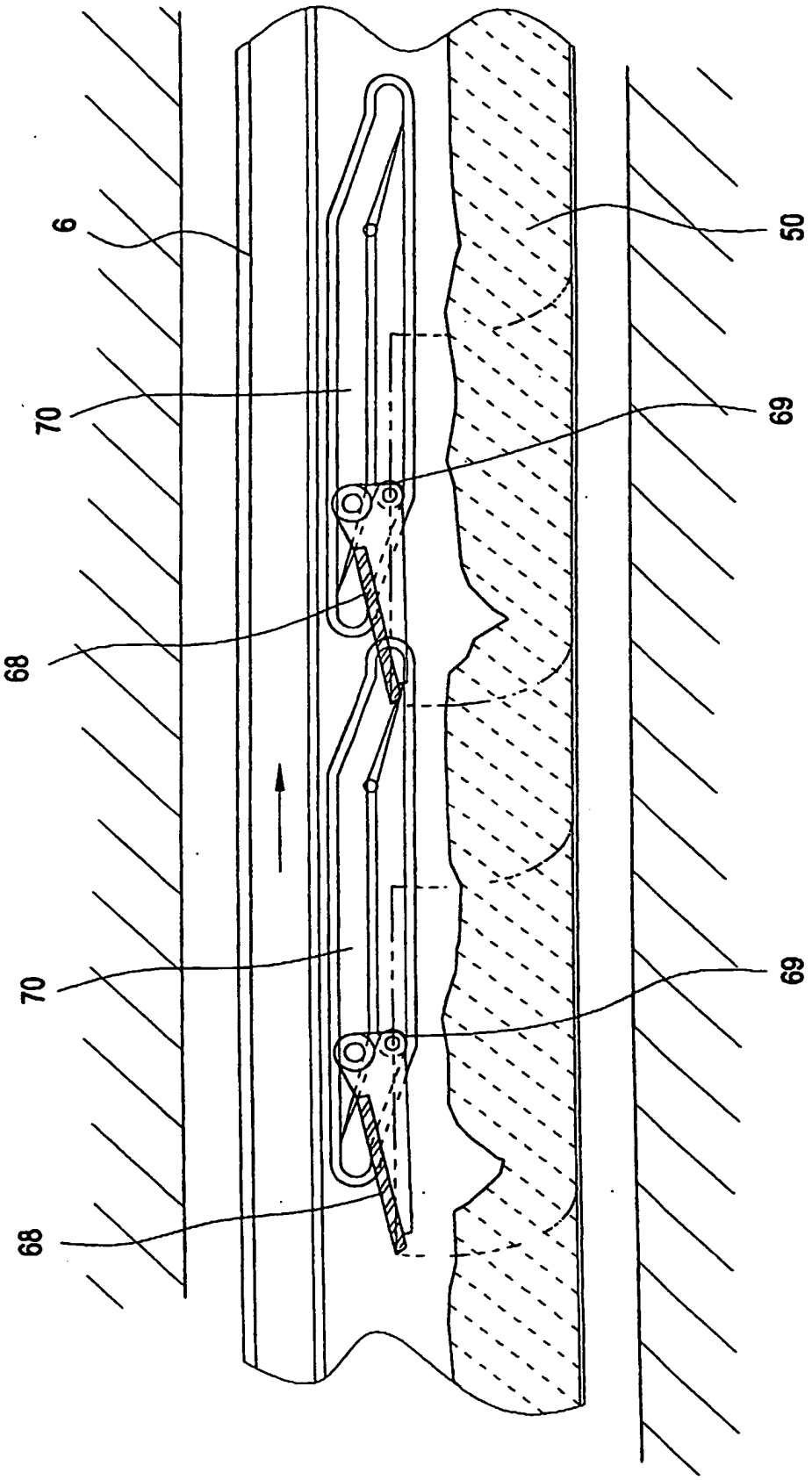

FIG. 19